Grassland Set-Aside Breeding Bird Survey

Connor Hawey

May – June 2023

Photo 1: Nest of a Savannah Sparrow in a grassland set-aside, May 2023

Program background

Grasslands have been identified as important habitats for birds, including several species at risk found in Delta, such as Barn Owl, Short-eared Owl and Pacific Great Blue Heron. The Delta Farmland and Wildlife Trust (DFWT) aims to improve grassland habitat in the Fraser River delta by entering into stewardship agreements with farmers to manage farmland as Grassland Set-asides (GLSA).

Farmers enter into stewardship agreements with the Delta Farmland and Wildlife Trust to establish Grassland Set-asides, which provide habitat for wildlife and improve soil quality. Fields are typically enrolled in the GLSA program for 4 years and are valuable in providing consistent breeding habitat, especially for species which return to the same site to breed that they were born at, such as Marsh Wrens (Kroodsma and Verner 2020).

Previous studies at DWFT demonstrate the utility of GLSAs in providing wintering habitat for species such as Townsend's Vole, Barn Owl, and Northern Harrier. The aim of this survey was to determine which species are using GLSAs for breeding and foraging habitat during the spring and summer months. By conducting point count surveys, we were able to survey for both birds that use GLSAs for breeding habitat and birds that use GLSAs for foraging habitat, either during migration or during the breeding season.

We also trialed the usage of autonomous recording units (ARUs) to passively record audio in the field. An automated classifier was then used to annotate the audio files with species identifications, allowing us to determine nearby bird species by their vocalizations. Compared with traditional point count surveys, ARUs can monitor for much longer periods of time and may be able to detect cryptic and migratory species with minimal in-field effort.

Methods

Point Count Surveys

Surveys were conducted at 7 grassland set-aside fields in Delta, BC. Within the 7 GLSA fields sampled, 15 point count locations were randomly selected. Point count locations were placed at least 100 m from the edge of the GLSA where possible, and at least 50 m from the edge when the shape of the GLSA did not allow for a 100 m distance. Point count locations within the same field were separated by at least 250 m.

Distance-based point counts of 100 m were conducted to measure songbird abundance within GLSAs (Resources Inventory Committee 1999). Five-minute point counts were conducted weekly from May 2 to June 21, 2022. Surveys began at sunrise and were completed within four hours. Surveys were not conducted when winds exceeded 12 km/hr, temperatures were below 7 °C, or during rain.

Point counts were limited to all species seen and heard within a 100 m detection radius. Observations were categorized under five distance increments: 0-5 m, 5-15 m, 15-35 m, and 35-50 m.

AudioMoth and BirdNET

From May 16 to June 9, we deployed AudioMoth ARUs within 4 of the grassland set-asides at the same location as a point count survey. Each ARU recorded daily for 2 hours before and after sunrise (4:30-8:30) and for 6 hours after dusk (22:00-4:00). Recordings at dawn were taken to capture the most active time for vocalizing songbirds and the recordings at dusk were taken to capture any vocalizing owls (Resources Inventory Committee 1999).

ARUs were equipped with three 2,800 mAh rechargeable AA batteries and a SanDisk 128GB SD card. They were heat-sealed within waterproof vacuum bags alongside a 5g pack of desiccant and attached with zip ties to a steel t-post to a height of 1.5m (Rhinehart 2021). Batteries and SD cards were changed after 10 days during times outside of the recording window (8:30-22:00).

BirdNET is an automated classifier developed by Cornell Lab of Ornithology and Chemnitz University of Technology that can annotate and extract bird calls detected from audio files (Kahl et al. 2021). We used the BirdNET analyzer version 2.4 to analyze all the audio files collected from the AudioMoths within GLSAs. We set BirdNET minimum confidence level to 0.1, sensitivity to 1, and overlap to 0. Species were filtered to a built-in list of expected birds encountered year-round in our area by selecting a latitude of 49 and longitude of -123 and location filter threshold of 0.03. All other settings were set as default and output as exported in R format.

After BirdNET analyzed the audio, we used the "Segments" tab to extract 3-second clips from the annotated audio files of all bird sounds detected with a confidence level above 0.1, up to a maximum of 100 files. We then manually verified all exported segments for every species until the species was confirmed to be present for greater than 7 days.

Results and Discussion

A total of 31 species were observed across 78 individual point counts conducted throughout the season. We considered a bird likely to be breeding in the area if it was observed during the survey at least three times out of seven visits (Resources Inventory Committee 1999). By these criteria, we observed 11 species that were using the GLSA for breeding habitat or that were nesting nearby and regularly using the set-aside for foraging habitat.

Grassland set-asides were categorized as being planted under two types of seed mixes: a Grass & Clover mix (n=3) or a Pollinator mix (n=4). No significant differences were detected between each of the mix types for either species richness or the number of presumed/confirmed breeding birds present in each GLSA (Figure 1).

	Species richness	*Breeding birds*
GLSA – Pollinator Mix	*9.7±2.5*	*2.7±0.6*
GLSA - Grass & Clover Mix	*14.7±5.7*	*3.0±2.2*

Figure 1. Species richness (number of species observed) and number of breeding bird species by GLSA type

Of the 11 breeding species observed at GLSAs, Savannah Sparrows were the only species presumed breeding at every site and were the most numerous species observed overall. Other breeding species frequently observed include Common Yellowthroat, American Robin, House Finch, and Red-winged Blackbird.

Grassland set-asides continue to provide crucial foraging habitat for Barn Swallows, which were present within every GLSA and were the third most frequently observed species

behind Savannah Sparrow and Common Yellowthroat. Since Barn Swallows rely on vertical structures to construct their nests, their nest site would not typically be located within a grassland set-aside. However, the open grassland environment provided by GLSAs is their preferred foraging habitat (Brown and Brown 2020). Barn Swallows are listed as a Threatened species in Canada and one of the contributing factors to their population decline is thought to be loss of breeding and foraging habitat due to land use change (COSEWIC 2011).

Overall, Audio Moth ARUs and BirdNET performed very well in recording and detecting birds based on their vocalizations. When counting all detections, species richness was higher using ARUs compared with point count surveys at 3 of the 4 sites (Figure 2). Because many detections from the ARUs were of migratory species, we filtered out a separate list of species that were present for at least 7 days and found that species richness was not significantly different between the ARU and point count surveys.

	ARU (All species)	*ARU (> 7 days)*	*Point Count (All species)*	*Point Count (Breeding birds)*
GLSA 1	*19*	*8*	*10*	*3*
GLSA 2	*8*	*2*	*11*	*3*
GLSA 3	*38*	*29*	*17*	*7*
GLSA 4	*21*	*10*	*5*	*3*
average ± sd	*21.5 ± 10.7*	*12.3 ± 10.1*	*10.8 ± 4.3*	*4.0 ± 1.7*

Figure 2. Species richness (number of species observed) by ARU and point count survey methods

An advantage of point count surveys is that the detection is limited to the bounds of the grassland set-aside field, with birds seen or heard outside the area being excluded. Since there is no limit on the ARU detection range, it is not known for certain if a bird was vocalizing within the GLSA, from a hedgerow, or from an adjacent field.

Despite this, we were able to gain valuable insights using ARUs in detecting migratory or temporary species. A Great Horned Owl was recorded at a GLSA and called one night only before leaving, migratory Black-headed Grosbeak and Wilson's Warblers were recorded presumably from adjacent hedgerows, and even the calls of a flyover Common Loon were detected. We even detected vocalizing amphibians during the overnight recording window (22:00-4:00), Green Frogs and Pacific Tree Frogs were recorded in every GLSA.

Works cited

Brown, M. B. and C. R. Brown (2020). Barn Swallow (Hirundo rustica), version 1.0. In Birds of the World (P. G. Rodewald, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA. https://doi.org/10.2173/bow.barswa.01

COSEWIC. 2011. COSEWIC assessment and status report on the Barn Swallow Hirundo rustica in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. ix + 37 pp. (www.sararegistry.gc.ca/status/status_e.cfm).

Kahl, S., C. M. Wood, M. Eibl, and H. Klinck (2021). BirdNET: A deep learning solution for avian diversity monitoring. Ecological Informatics 61:101236.

Kroodsma, D. E. and J. Verner (2020). Marsh Wren (Cistothorus palustris), version 1.0. In Birds of the World (A. F. Poole, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA. https://doi.org/10.2173/bow.marwre.01

Resources Inventory Committee (1999). Inventory methods for forest and grassland songbirds. Ministry of Environment, Lands and Parks, Victoria, BC.

Rhinehart, Tessa A (2021). AudioMoth: a practical guide to the open-source ARU. GitHub repository: https://github.com/rhine3/audiomoth-guide. DOI: https://doi.org/10.5281/zenodo.4976243

Species list

Point Count Surveys

All species observed; in order of abundance Species marked with (*) were observed at the same site at least 3 of 7 visits, and were presumed breeding within the GLSA or nearby
Savannah Sparrow*
Common Yellowthroat*
Barn Swallow*
Red-winged Blackbird*
American Robin*
Song Sparrow*
American Goldfinch*
House Finch
White-crowned Sparrow
American Crow
European Starling*
Marsh Wren*
Eurasian Collared-Dove
Killdeer
Brown-headed Cowbird
Bald Eagle*
Brewer's Blackbird*
Tree Swallow
Black-capped Chickadee
Cedar Waxwing
Spotted Towhee
House Sparrow
Bewick's Wren
Great Blue Heron
Yellow Warbler
Willow Flycatcher
Mallard
Black-headed Grosbeak
Wilson's Snipe
Northern Flicker
Northern Harrier

AudioMoth + BirdNET

All species detected by ARUs and manually verified
American Crow
American Goldfinch
American Kestrel
American Pipit
American Robin
Anna's Hummingbird
Bald Eagle
Barn Swallow
Black-bellied Plover
Black-capped Chickadee
Black-headed Grosbeak
Brewer's Blackbird
Brown-headed Cowbird
Bushtit
Canada Goose
Caspian Tern
Cedar Waxwing
Common Loon
Common Yellowthroat
Eurasian Collared-Dove
European Starling
Evening Grosbeak
Gadwall
Golden-crowned Kinglet
Great Blue Heron
Great Horned Owl
Greater Yellowlegs
House Finch
House Sparrow
Killdeer
Lesser Yellowlegs
Mallard
Northern Flicker
Red-winged Blackbird
Savannah Sparrow
Song Sparrow
Spotted Sandpiper
Spotted Towhee
Swainson's Thrush
Tree Swallow
Violet-green Swallow
White-crowned Sparrow
Wilson's Warbler
Yellow-rumped Warbler